Row 1, Extraction

- Fuel (certain colas) running out; natural gas (2 votes)
- Environmental impacts of coal bed methane production—water quality, salts on surface—produced water impacts and lack of way to use that water, or dispose of it (high cost of treatment) (4 votes)
- Availability of fresh water for production
- Lack of understanding of long term hydrologic impacts of produced water management, esp CBM
- Oil shale uses a lot of water and issues of quality and quantity
- Coal mine drainage
- High cost
-

Row 2, Fuel Production

Row 3, Electricity Production

- Understand water use of "clean coal" technologies (gasification, slurry pipelines)
- Transportation of resource, lack of power lines
- Relicensing of hydro
    - Lack of research and data on environmental impacts, ecological impacts (2 votes)
    - Electricity transfers do not include water calculation interstate/interbasin
    - Large, central energy generation infrastructure is outdated, not sustainable, grid, rail lines interconnection to east-west; barges and water levels (7 votes)
- Guaranteeing a firm water supply for drought cycles for new power plants (1 vote)
- Cooling
    - Efficiency hit with dry cooling (2 votes)
    - Water supply for wet cooling—conversions (2 votes)
    - Impacts on air quality due to fuel needed

Row 4, Renewables

- Pumped storage, problem with dispatch optimization—renewables, hydro, fossils with intermittent resources (7/11 votes)
- Infrastructure problems with control/dispatch
- Lack of understanding of water impacts of pumped storage
- Ethanol requires significant quantity of water (NT problem)
- Methane production from fry feedlots require water (NT problem)
- Hydrogen production needs water (1 vote)
- Water used to produce PV cells, and disposal

- Costs of renewables compared to other sources (better understanding)
- Intermittency/dispatchability

Row 5, Energy, Other

- "Storage" technologies and management (electric vs other uses) (4 votes)
- Lack of integrated planning/analysis tools—economic, regulatory. "non traditional" economic of costs/benefits, air quality, water quality (7 votes)
    - Problem with implementation
- Lack of economic signal to induce energy conservation (3 votes)
- Lack of public education for conservation
- Energy and water conservation should be linked as a policy tool and technology-wise (2 votes)

Cross-cutting

- Lack of long-term regional planning to deal with drought cycles and impact on electric supply; water rights; infrastructure (increasing problem) (4 votes)
- Better understanding of health risks of using effluent streams/re-use of effluent streams (static problem)
- Limited supply of water in the west, especially high quality (increasing problem) (1 vote)
- Lack of technologies, approaches for water efficiency
- Lack of data and research on crop-coefficients
- Models
    - Lack of models for management of specific basins—droughts, competing users, lack of data to run models (5 votes)
- Lack of ability actually measure surface water—lost 1000 gauges in past
    - Lack of ability to measure quantity and quality of all water resources (4 votes)
- Overall categories
    - Data sharing/case studies
    - Modeling
    - Technology RD&D
    - Pricing/economics/valuation
    - New sources
    - Collect info and analyze complexity of various overlying authorities, regulations, policies
        - Case studies
        - Decision trees

- Understanding groundwater
    - Monitoring, costs, drought impacts, depletion (increasing problem) (4 votes)
- Water rights issues are complicated, hard to understand (increasing problem) (2 votes)
- Competing uses—how to balance needs/demands of various end-users (electric, recreation, urban, ag, wildlife, fisheries) (increasing problem) (5 votes)
- Lack of "point of use" collection systems (eg rooftop collection systems)
- Leak detection technologies could be improved (2 votes)
- Reluctance to use efficiency technology in urban landscaping—cemeteries, golf courses, parks, highways. Target efficiency technologies to get the biggest benefits of savings. (1 vote)
- Lack of public education/awareness of water scarcity/knowledge of conservation/efficiency in all climate conditions (drought goes away)
- Impervious surfaces in urban settings—runoff and impacts on recharge
- Lack of water storage capacity—dams. Lack of research on "intelligent storage." (2 votes)
- Source water protection planning, tools, implementation

- Identify issues/impacts with interstate transfer—states, reservations—issues are not clear or understood. Include all stakeholders. (1 vote)
- Disconnect between political and S&T realms.
- Incentives for water conservation
    - There aren't any
- Lack of value of water. Water not valued properly.
- Degraded infrastructure of distribution network for water.
- Treatment of supply water (6 votes)
    - Segregated by intended use—residential, industrial, runoff all treated the same
- R&D of technologies, techniques of dual use systems
- Dissemination of case studies for dual use systems, re-use of effluent
- Need more funding for this (dual use)
- Cost/benefit analysis of dual use system—large scale analysis

Priority Energy Problems

- Optimization/integration—dispatch of technologies
- Infrastructure
- Planning—Lack of integrated tools/policies/models

Priority Water Problems

- Lack of data/integrated models/data fragmentation
    - Drought cycles impacts on climate change for long-term planning
    - Groundwater supplies/use
    - Surface water supply/use
    - Integrated with energy use
- Match water quality, use, and treatment
- Balancing competing uses
    - No guidance, policy.
    - No metrics.

Overall Needs

- NEED: Additional funding $$ for R&D
- NEED: Fund specific section of EPACT related to energy-water
- NEED: Support commercialization efforts of new renewable technologies through industry partnerships

Energy Needs

- NEED: More cooperation between DOE and utilities—share data, cost-shared R&D, data bank; confidentiality standards
- NEED: Expand opportunities for storage and use of off-peak power
- NEED: Develop some type of guidelines, metrics of what we mean by drought—consistent definitions
- NEED: Look at "worse case" drought year, and then make it worse than that
- NEED: Analysis of climate change impacts on hydro power generation
- NEED: RESOURCE PLANNING: Need to develop models, decision support tools for truly integrated planning—water, electric, air, DG included (8 votes)
- NEED: RESOURCE PLANNING: Consistent water supply/demand modeling for long term supply
- NEED: RESOURCE PLANNING: Common metrics to value non-traditional benefits—externalities included in resource cost-benefit analysis
- NEED: Data sharing, secure data banks, and be able to distribute and make available to researchers—both energy and water
- NEED: Additional support and development of conservation and efficiency technologies – water and energy (8 votes)
- NEED: Pricing policies to look at true price of power and water. Evaluate joint impact of energy and water pricing policies—integrated assessment. (2 votes)
- NEED: Greater effort to bring on hydro power at existing dams where turbines do not exist (1 vote)

- NEED: More LNG facilities now
- NEED: Neutral evaluation of performance of new technologies (independent, unbiased) leading to certification (2 votes)
- NEED: National contest for new technologies like refrigerator contest
- NEED: RD&D on integrating non-dispatchable resources into the grid (8 votes)
    - Storage, superconductors, control technologies, pricing policies
    - Demonstration projects in partnerships with industry, esp storage, controls
    - Superconductors, transmission lines/grid issues
    - Cooperate with EU on R&D into integration of renewables

Priority Water Problem: Balancing Competing Uses

- NEED: Develop consistent BMPs for energy/water conservation
- NEED: Valuation analysis of clean water and pricing policies to encourage use of wastewater by power industry—often cheaper to use fresh water over grey water
- NEED:
- NEED:

- SOLN: Develop a "WaterStar" program (2 votes)
  - EPA with DOE input
  - Certify facilities (e.g., waste water treatment plants, golf courses) and commercial, industrial, residential water using appliances
- SOLN: Efficient air conditioner contest (2 votes)
- SOLN: Radically change water pricing structure
- SOLN: R&D support for technologies to replace steam cycle; or convert to combined cycle. Support IGCC research.
- SOLN: Support development and deployment of small scale power generation systems. Deploy systems in order to avoid upgrades to distribution system. (3 votes)
- SOLN: Develop data bank for data collection, sharing, analysis (3 votes)
- SOLN: Genetic engineering to allow crops to use less water and lower quality water (1 vote)
- SOLN: R&D into improved materials for conductors—DOE
- SOLN: R&D support for non-silicon based PV cells—DOE
- SOLN: Implement CRP for water (Water banking)—USDA, water associations, districts
- SOLN: Develop and implement aggressive public education program—DOE, states, utilities, school (2 votes)
- SOLN: R&D support for pumped storage, batteries, flywheels, making ice, hydrogen, thermal energy storage (5 votes)
- SOLN: Helium cooling technologies
- SOLN: R&D into technologies to minimize water use in next generation nuclear power plants
- SOLN: Investigate small scale (10 MW) DB based on nuclear technology
- SOLN: Investigate wave energy
- SOLN: Implement certification program for new technologies and BMP (1 vote)
- SOLN: Develop remote sensing technologies to measure snowpack, water use by crops for modeling and forecasting. Measurement technology (1 vote)
- SOLN: Develop integrated modeling tools that address energy, water supplies, demands, impacts, competing uses, air quality, population (5 votes)
- SOLN: Develop grid integration control technologies, policies, methods for renewables and DG (3 votes)
- SOLN: Develop and implement leak detection technologies
- SOLN: Develop improved transportation technologies (1 vote)
- SOLN:
- SOLN:
- SOLN:

Random Solutions Page

- SOLN: Money
- SOLN: Import ice bergs
- SOLN: Rainmaking
- SOLN: Gas pipelines from Canada

Policy/Regulatory Flipchart

- FERC relicensing process
- Permitting process for large coal plants
- Regs do not recognize/understand new technologies (long term issue)
- Lack of recognition of tribal capacities/resources in planning process
- Lack of incentives to give credit for renewable energy use
- Property rights of water
- Endangered species act
- NPEA—how water is dealt with in terms of energy development
- Coordinate with energy bill language
- Regs of interconnection/net metering/retail wheeling
- Quantification/allocation of water rights
- Multiple agencies regulating water supply, quality, use at state, federal, tribal levels
- Beneficial uses—use it or lose it doctrine
- NEED: consistent national policy toward renewables (e.g. production tax credit, portfolio standards, and efficiency standards, building codes
- NEED: Consistent transmission policies
- NEED: Coordination or legal analysis of gaps in energy/water policies
- NEED: Streamline FERC policy for relicensing—need a "One Stop Shop"